

Belowground Distribution and Abundance of *Botrychium* Gametophytes and Juvenile Sporophytes

CINDY JOHNSON-GROH¹, CHANDRA RIEDEL²,
LAURA SCHOESSLER³, and KRISSA SKOGEN⁴

Biology Department, Gustavus Adolphus College, 800 W. College Ave., St. Peter, MN 56082

ABSTRACT.—A significant portion of the stages of the life history of *Botrychium*, the gametophyte and juvenile sporophytes, are spent belowground. Surveys were conducted to determine the distribution and abundance of belowground gametophytes, juvenile sporophytes and gemmae of eight species of *Botrychium*. For each species, soil samples were collected in a 200 m² area, sifted through a series of soil sieves, and centrifuged to separate the lighter plant material. Only 40% of the soil samples contained belowground structures revealing a patchy distribution. The gametophytes of *B. montanum* are most dense, followed by *B. mormo* with 738 and 728 gametophytes m⁻² respectively. *Botrychium hesperium* also has a relatively high density of 478 gametophytes m⁻². *Botrychium gallicomontanum* is the least dense with 10 gametophytes m⁻². *Botrychium campestre* and *B. gallicomontanum* both have abundant gemmae and few gametophytes. The density of individuals in the belowground structure bank greatly exceeds the aboveground population. The size and health of the belowground structure bank is critical in sustaining the long-term aboveground population and in buffering it from extinction.

The importance of propagule banks (also referred to as seed, spore, or diaspore banks) in community dynamics has long been recognized (Leck et al., 1989) for flowering plants. Propagules may persist belowground for many years, creating a secure reservoir from which aboveground plants can be reestablished following extinction during unfavorable environmental conditions. The propagule bank serves as a buffer against extinction during unfavorable environmental conditions as a reservoir of genes, and as such is an important factor in determining community dynamics.

Relatively few studies have documented the propagule banks of ferns. In previous studies, soil has been collected, and spread in containers in glasshouses to cultivate spores that may be present in the propagule bank (Dyer and Lindsay, 1992; During and ter Horst, 1983; Hamilton, 1988; Milberg, 1991; Schneller, 1988). Three major trends have been noted. First, the density of fern gametophytes resulting from cultivation of spore banks is high, ranging from 57,000 spores m⁻² (Milberg, 1991) to 5,000,000 m⁻² (Schneller, 1988). Second, the abundance of fern spores in the spore bank is a result of the longevity of spores and the long-term accumulation of spores (Dyer, 1994; Milberg, 1991). Third, when comparing the belowground density

¹ Corresponding author.

² Current address: Dept. of Botany, 353 Bessey Hall, Iowa State University, Ames, IA 50011.

³ Current address: Dept. of Ecology, Evolution and Behavior, University of Minnesota, 100 Ecology Bldg., 1987 Upper Buford Circle, St. Paul, MN 55108.

⁴ Current address: Argonne Nat'l. Laboratory, 9700 S. Cass Ave., Bldg. 203, Rm. E121, Argonne, IL 60439.